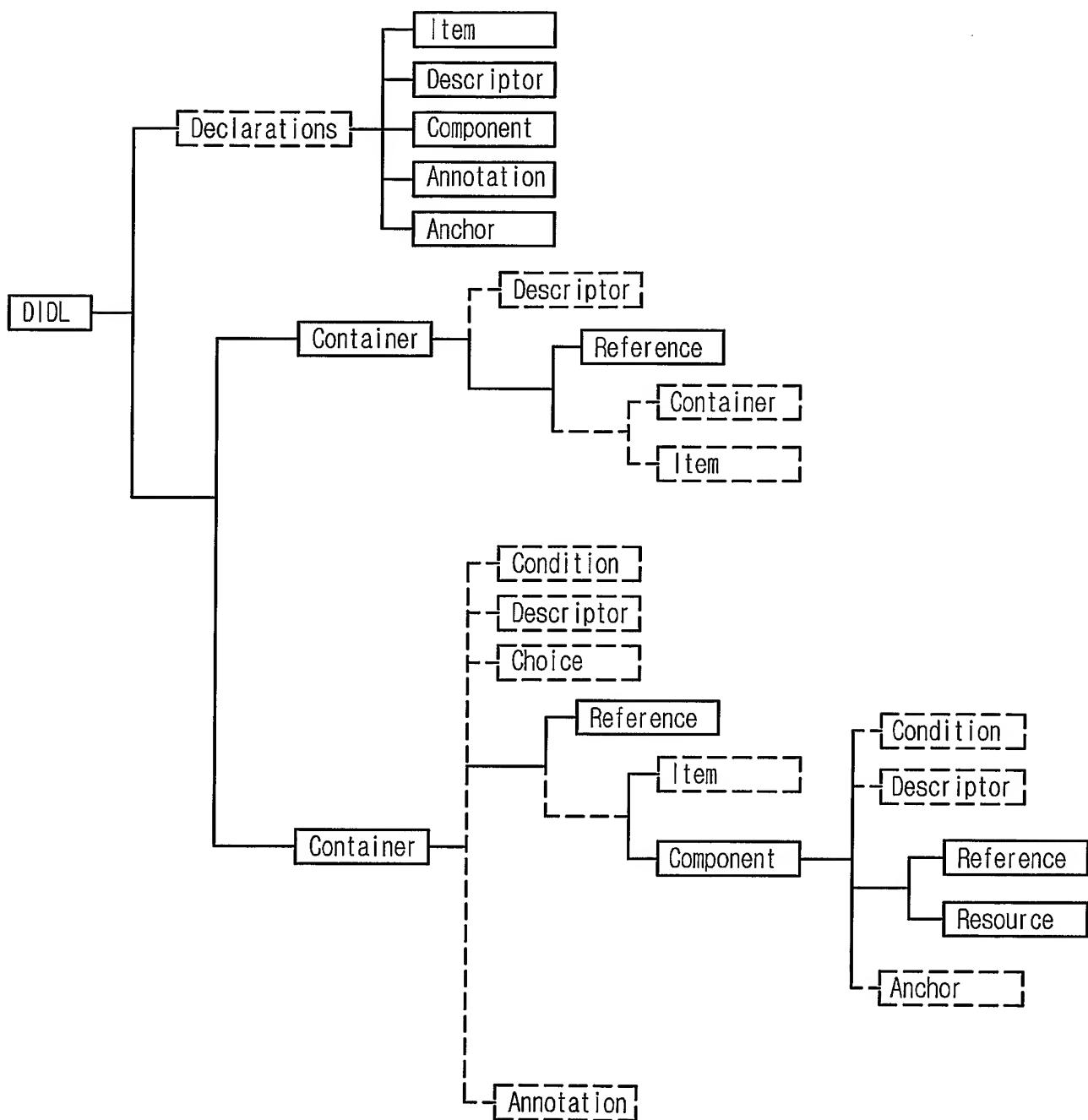


FIG. 1
(PRIOR ART)



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FIG.2

<i>Relation Name</i>	<i>Inverse Relation</i>	<i>Definition</i>	<i>Properties</i>	<i>Examples (informative)</i>
precedes	follows	B precedes C if and only if $B.b < C.a$	Transitive	BBB CCC
meets	metBy	B meets C if and only if $B.b = C.a$	Anti-symmetric	BBBCCC
overlaps	overlappedBy	B overlaps C if and only if $B.a < C.a$ AND $B.b > C.a$ AND $B.b < C.b$		BBB CCC
contains	during	B contains C if and only if $(C.a > B.a$ AND $C.b \leq B.b)$ OR $(C.a \geq B.a$ AND $C.b < B.b)$	Transitive	Any of the examples for strict Contains, startedBy, and finishedBy.
strictContains	strictDuring	B strictContains C if and only if $C.a > B.a$ AND $C.b < B.b$	Transitive	BBBBBBBB CCCC
starts	startedBy	B starts C if and only if $B.a = C.a$ AND $B.b < C.b$	Transitive	BBBB CCCCCC
finishes	finishedBy	B finishes C if and only if $B.a > C.a$ AND $B.b = C.b$	Transitive	BBBB CCCCCC
coOccurs	coOccurs	B coOccurs C if and only if $B.a = C.a$ AND $B.b = C.b$	Equivalence	BBB CCC

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FIG.3

<i>Relation Name</i>	<i>Definition</i>	<i>Examples (informative)</i>
contiguous	A_1, A_2, \dots, A_n contiguous if and only if $A_i.b = A_{i+1}.a$ for $i=1, \dots, n-1$. That is, A_1, A_2, \dots, A_n contiguous if and only if they are temporally disjoint and connected.	$A_1A_1A_1A_2A_2\dots A_nA_nA_n$
sequential	A_1, A_2, \dots, A_n sequential if and only if $A_i.b \leq A_{i+1}.a$ for $i=1, \dots, n-1$. That is, A_1, A_2, \dots, A_n sequential if and only if they are temporally disjoint and not necessarily connected.	$A_1A_1A_1$ $A_2A_2\dots A_nA_nA_n$
coBegin	A_1, A_2, \dots, A_n coBegin if and only if $A_i.a = A_{i+1}.a$ for $i=1, \dots, n-1$. That is, A_1, A_2, \dots, A_n coBegin if and only if they start at the same time.	$A_1A_1A_1$ A_2A_2 ... $A_nA_nA_n$
coEnd	A_1, A_2, \dots, A_n coEnd if and only if $A_i.b = A_{i+1}.b$ for $i=1, \dots, n-1$. That is, A_1, A_2, \dots, A_n coEnd if and only if they end at the same time.	$A_1A_1A_1$ A_2A_2 ... $A_nA_nA_n$
parallel	A_1, A_2, \dots, A_n parallel if and only if the intersection of A_1, A_2, \dots, A_n has one non-empty interior.	$A_1A_1A_1$ A_2A_2 ... $A_nA_nA_n$
overlapping	A_1, A_2, \dots, A_n overlapping if and only if the union of A_1, A_2, \dots, A_n is connected and each A_i intersects at least one other A_j with non-empty interior.	$A_1 A_1 A_1$ $A_2A_2A_2A_2$... $A_nA_nA_n$

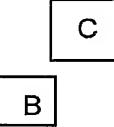
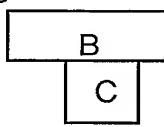
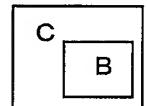
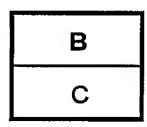
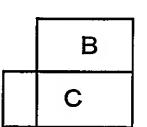
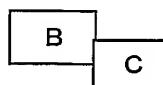
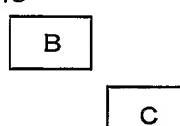
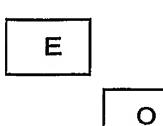
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FIG.4A

<i>Relation Name</i>	<i>Inverse Relation</i>	<i>Definition</i>	<i>Properties</i>	<i>Informative Examples</i>
south	north	B south C if and only if ((B.x.a ≥ C.x.a AND B.x.b ≤ C.x.b) OR (B.x.a ≤ C.x.a AND B.x.b ≥ C.x.b)) AND B.y.b ≤ C.y.a	Transitive	<div style="display: flex; justify-content: space-around;"><div style="text-align: center;"><div style="border: 1px solid black; padding: 2px;">C</div></div><div style="text-align: center;"><div style="border: 1px solid black; padding: 2px;">B</div></div></div>
west	east	B west C if and only if B.x.b ≤ C.x.a AND ((B.y.a ≥ C.y.a AND B.y.b ≤ C.y.b) OR (B.y.a ≤ C.y.a AND B.y.b ≥ C.y.b))	Transitive	<div style="display: flex; justify-content: space-around;"><div style="text-align: center;"><div style="border: 1px solid black; padding: 2px;">B</div></div><div style="text-align: center;"><div style="border: 1px solid black; padding: 2px;">C</div></div></div>
northwe st	southeast	B northwest C if and only if B.x.b ≤ C.x.a AND B.y.a ≥ C.y.b	Transitive	<div style="display: flex; justify-content: space-around;"><div style="text-align: center;"><div style="border: 1px solid black; padding: 2px;">B</div></div><div style="text-align: center;"><div style="border: 1px solid black; padding: 2px;">C</div></div></div>
southwe st	northeast	B southwest C if and only if B.x.b ≤ C.x.a AND B.y.b ≥ C.y.a	Transitive	<div style="display: flex; justify-content: space-around;"><div style="text-align: center;"><div style="border: 1px solid black; padding: 2px;">C</div></div><div style="text-align: center;"><div style="border: 1px solid black; padding: 2px;">B</div></div></div>
left	right	B left C if and only if B.x.b ≤ C.x.a	Transitive	<div style="display: flex; justify-content: space-around;"><div style="text-align: center;"><div style="border: 1px solid black; padding: 2px;">B</div></div><div style="text-align: center;"><div style="border: 1px solid black; padding: 2px;">C</div></div></div>

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FIG. 4B

below	above	B below C if and only if $B.y.b \leq C.y.a$	Transitive	
over	under	B over C if and only if $((B.x.a \leq C.x.a \text{ AND } B.x.b > C.x.a) \text{ OR } (B.x.a > C.x.a \text{ AND } B.x.a < C.x.b)) \text{ AND } B.y.a = C.y.b$	Transitive	
equals	equals	B equals C if and only if $B = C$	Equivalence	
inside	contains	B1, B2, ... Bn inside C if and only if $(B1, B2, \dots, Bn) \subseteq C$	Partial order	
covers	coveredBy	B1, B2, ... Bn covers C if and only if $B1 \cup B2 \cup \dots \cup Bn \cup C \supseteq C$ $\text{AND } (B1 \cup B2 \cup \dots \cup Bn \cup C) \neq C$	Transitive	
overlaps	overlaps	B overlaps C if and only if B ∩ C has non-empty interior	Symmetric	
touches	touches	B1, B2, ... Bn touches C if and only if B1 ∪ B2 ∪ ... ∪ Bn ∪ C is connected	Equivalence	
disjoint	disjoint	B disjoint C if and only if $B \cap C = \emptyset$	Symmetric	
separated	separated	E separated O if and only if $E \cap \text{cl}(O) = \emptyset \text{ AND } \text{cl}(E) \cap O = \emptyset$ where cl(S) indicates the closure of a set S.	Symmetric	

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FIG.5

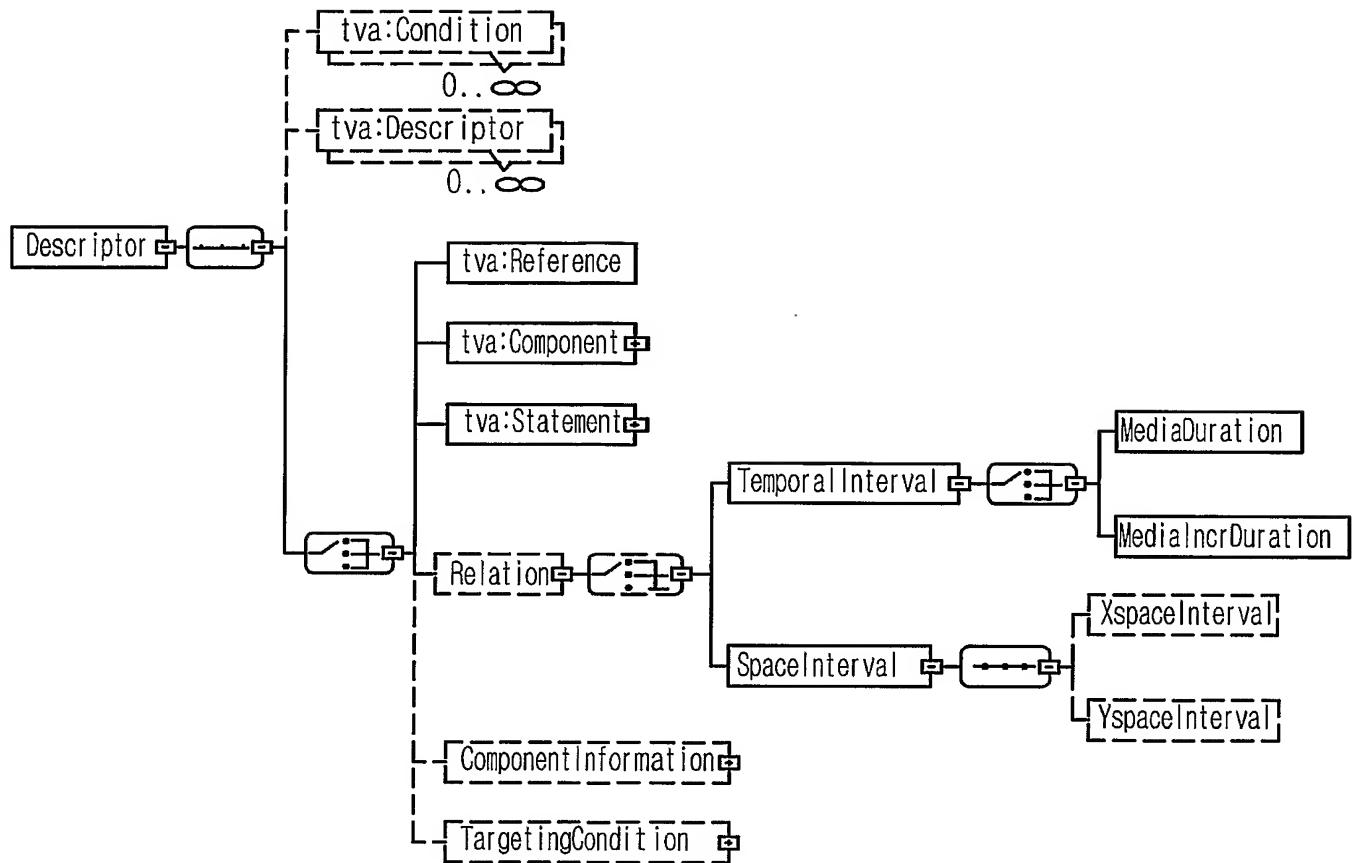
```
<Selection select_id="Temp_precedes">
<Descriptor>
<Relation type="urn:tva:metadata:phase2:CS:TemporalRelationCS:2005:precedes">
<TemporalInterval>
<MediaIncrDuration mediaTimeUnit="PT1N1000F">3000
</MediaIncrDuration>
<!-- <MediaDuration>PT3S</MediaDuration>-->
</TemporalInterval>
</Relation>
</Descriptor>
</Selection>
```

FIG.6

```
<Selection select_id="Spatial_west">
<Descriptor>
<Relation type="urn:tva:metadata:phase2:CS:SpatialRelationCS:2005:west">
<SpaceInterval spaceIntervalUnit="S1 N1000F">
    <XspaceInterval>200</XspaceInterval>
</SpaceInterval>
</Relation>
</Descriptor>
</Selection>
```

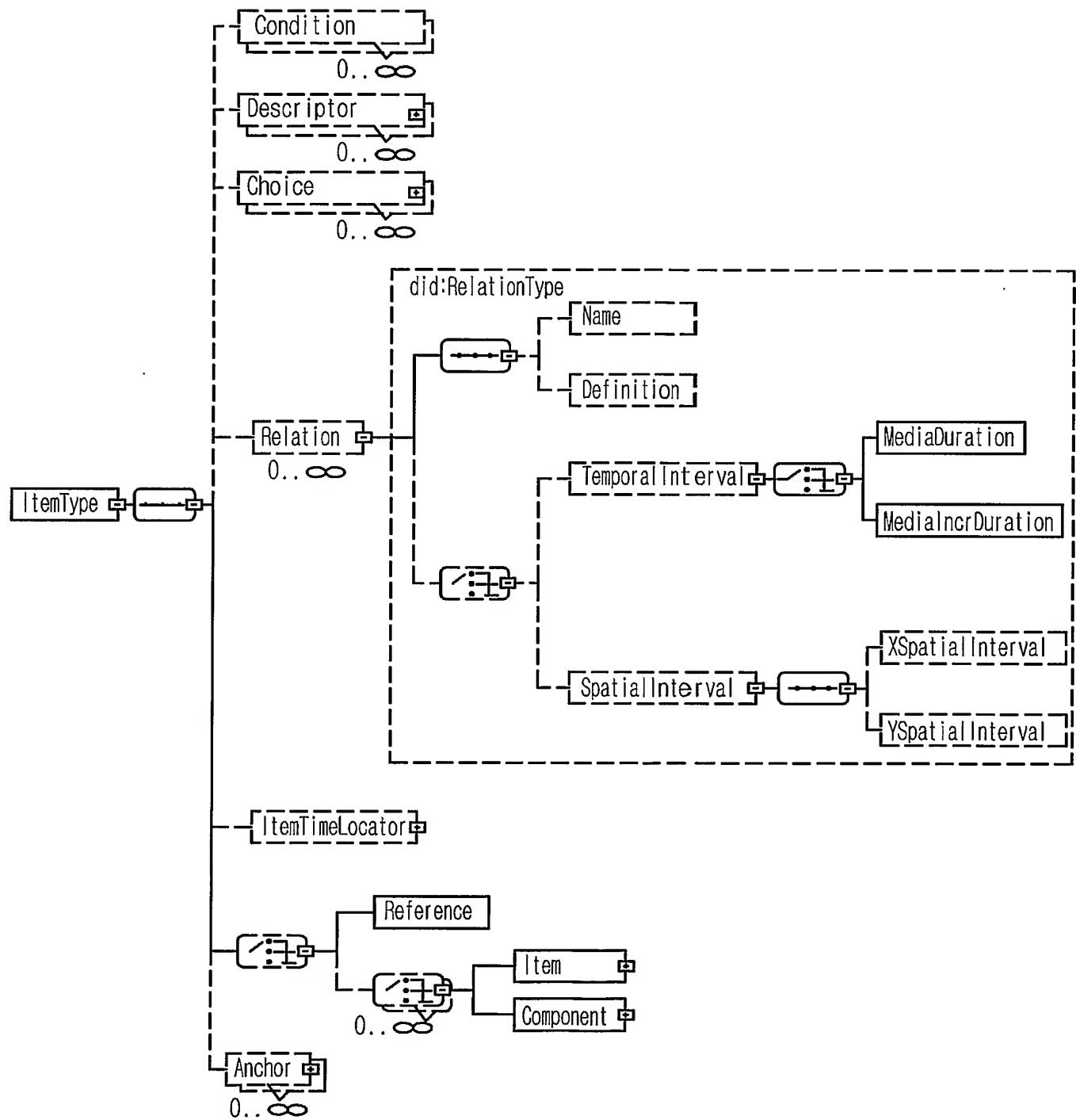
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FIG. 7A



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FIG. 7B



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FIG. 7C

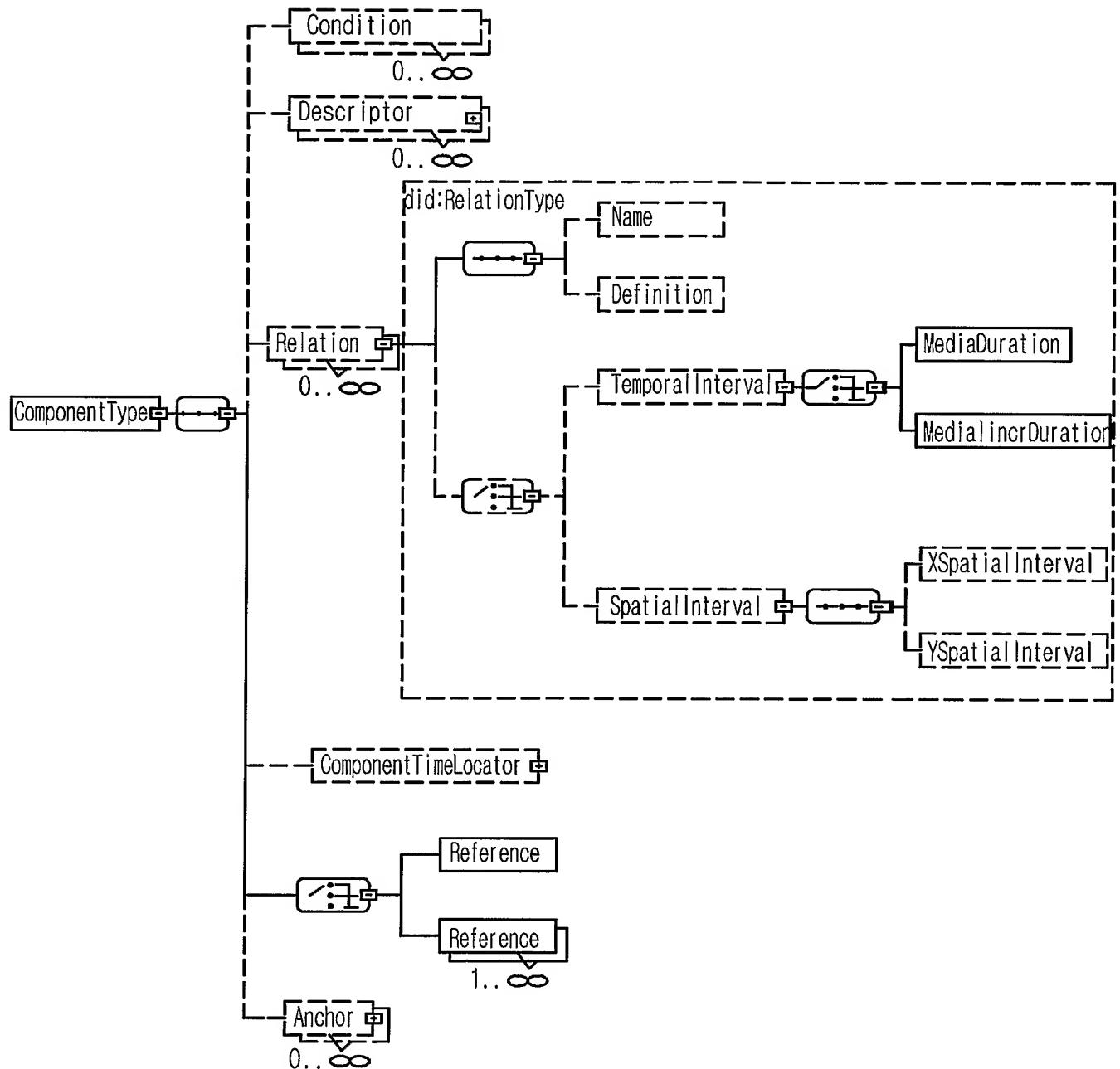


FIG.8

```
<element name="Relation" minOccurs="0">
<complexType>
<choice minOccurs="0">
<element name="TemporalInterval">
<complexType>
<choice>
<element name="MediaDuration" type="mpeg7:mediaDurationType"/>
<element name="MedialncrDuration" type="mpeg7:Medialncr
DurationType"/>
</choice>
</complexType>
</element>
<element name="SpaceInterval">
<complexType>
<sequence>
<element name="XspaceInterval" type="integer" minOccurs="0"/>
<element name="YspaceInterval" type="integer" minOccurs="0"/>
</sequence>
<attribute name="spaceIntervalUnit" type="tva:SpatialRel
IntervalType"/>
</complexType>
</element>
</choice>
<attribute name="type" type="mpeg7:termReferenceType" use=
"optional"/>
</complexType>
</element>
```

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FIG.9A

```
<TVAMain xmlns="urn:tva:metadata:2002"
  xmlns:mpeg7="urn:mpeg:mpeg7:schema:2001"
  xmlns:dia="urn:mpeg:mpeg21:2003:01-DIA-NS"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="urn:tva:metadata:2002 ./PackageWithDID7.xsd">
  <ProgramDescription>
    <PackageInformationTable>
      <Container id="Educational_Package">
        <Item>
          <Choice minSelections="1" maxSelections="1">
            <Selection select_id="Phrase_One">
              <Descriptor>
                <Statement mimeType="text/plain"> Phrase One</Statement>
```

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FIG. 9B

```
</Descriptor>
</Selection>
<Selection select_id="Phrase_Two">
<Descriptor>
<Statement mimeType="text/plain">Phrase Two</Statement>
</Descriptor>
</Selection>
</Choice>
<Choice minSelections="1" maxSelections="2">
<Selection select_id="Selection_Optional">
<Descriptor>
<Relation type="urn:tva:metadata:cs:SelectionCS:
2003:Optional"/>
</Descriptor>
</Selection>
<Selection select_id="Temp_coBegin">
<Descriptor>
<Relation type="urn:mpeg:mpeg7:cs:TemporalRelationCS:
2001:coBegin"/>
</Descriptor>
</Selection>
<Selection select_id="Temp_precedes">
<Descriptor>
<Relation type="urn:mpeg:mpeg7:cs:TemporalRelationCS:
2001:precedes">
<TemporalInterval>
<MediaIncrDuration mediaTimeUnit="PT1N1000F">
3000</MediaIncrDuration>
<!-- <MediaDuration>PT3S</MediaDuration>-->
</TemporalInterval
</Relation>
```

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FIG. 9C

```
</Descriptor>
</Selection>
<Selection select_id="Spatial_west">
<Descriptor>
<Relation type="urn:mpeg:mpeg7:cs:SpatialRelationCS:
2001:west">
<SpaceInterval spaceIntervalUnit="S1N1000F">
<XspaceInterval>200</XspaceInterval>
</SpaceInterval>
</Relation>
</Descriptor>
</Selection>
</Choice>
<Choice minSelections="1" maxSelections="1">
<Selection select_id="Audio_WAV">
<Descriptor>
<TargetingCondition>
<TerminalCondition xsi:type="dia:CodecCapabilitiesType">
<dia:Decoding xsi:type="dia:AudioCapabilitiesType">
<dia:Format href="urn:mpeg:mpeg7:cs:FileFormatCS
:2001:9">
<mpeg7:Name xml:lang="en">WAV</mpeg7:Name>
</dia:Format>
</dia:Decoding>
</TerminalCondition>
</TargetingCondition>
</Descriptor>
</Selection>
<Selection select_id="Audio_MP3">
<Descriptor>
<TargetingCondition>
.....
</TargetingCondition>
```

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FIG. 9D

```
</Descriptor>
</Selection>
</Choice>
<Item>
<Condition require="Spatial_west"/>
<Item>
<Condition require="Temp_precedes"/>
<Item>
<Condition require="Phrase_One Temp_coBegin"/>
<Item>
<Component>
<Condition require="Audio_WAV"/>
<Resource mimeType="audio/wav"
crid="crid://www.imbc.com/EnglishEducation/
FirstPhrase" imi="imi:1"/>
</Component>
<Component>
<Condition require="Audio_MP3"/>
<Resource mimeType="audio/mp3"
crid="crid://www.imbc.com/EnglishEducation/
FirstPhrase" imi="imi:2"/>
</Component>
</Item>
```

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FIG.9E

```
<Component>
<Resource mimeType="text/plain"
crid="crid://www.imbc.com/EngScriptperPhrase
/FirstPhrase"/>
</Component>
<Component>
<Resource mimeType="text/plain"
crid="crid://www.imbc.com/KorScriptperPhrase/FirstPhrase"/>
</Component>
</Item>
<Item>
<Condition require="Phrase_Two Temp_coBegin"/>
<Component>
<Resource mimeType="audio/wav"
crid="crid://www.imbc.com/EnglishEducation/
SecondPhrase"/>
</Component>
<Component>
<Resource mimeType="text/plain"
crid="crid://www.imbc.com/EngScriptperPhrase/
SecondPhrase"/>
</Component>
<Component>
<Resource mimeType="text/plain"
crid="crid://www.imbc.com/KorScriptperPhrase/
SecondPhrase"/>
</Component>
</Item>
```

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FIG.9F

```
</Item>
<Item>
<Condition require="Selection_Optional"/>
<Component>
<Resource mimeType="image/gif"
crid="crid://www.imbc.com-/ImagesforLinkedMaterial/EnglishBook"/>
</Component>
<Component>
<Resource mimeType="image/gif" crid="crid://www.imbc.com-
/ImagesforLinkedMaterial/StudyMethod"/>
</Component>
</Item>
</Item>
</Item>
</Container>
</PackageInformationTable>
</ProgramDescription>
</TVAMain>
```

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FIG. 10

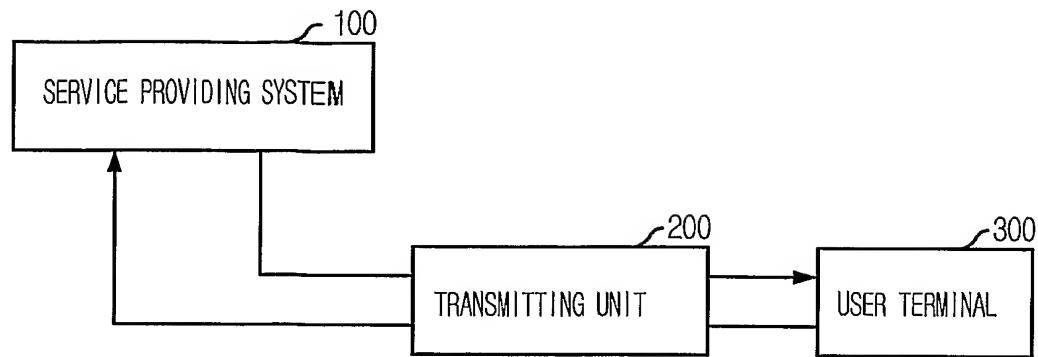


FIG. 11

